KEENAN PROPERTIES

SPEARFISH, LAWRENCE COUNTY

SOUTH DAKOTA

Tin, Columbium, Tantalum and Tungsten Concentrates. High grade Soda and Potash Feldspars, 20 to 200 mesh.

Field Operators: Duffy Construction Corporation
230 Park Avenue,
New York

Consulting Engineers: The Dorr Company
Stamford, Connecticut.

Walter W. Johnson
San Francisco, California

Consulting Chemist: Oscar N. Bribach
Aurora, Colorado.

Reference: Mr. W. Robert Hunter, Hunter, Prugh, Ball & Davidson, Inc., 607 Winters Bank Building, Dayton, Ohio.

UNITED STATES DEPARTMENT OF
COMMERCE
CHARLES SAWYER, SECRETARY WASHINGTON 25, D. C.

National Production Authority

Lubin - 4445 NPA - 30

For Immediate Release
Friday, October 20, 1950

The entire production and use of columbium bearing stainless steels will be reserved for defense needs under an order issued today by the National Production Authority.

This action is being taken, NPA said, because ferro-columbium and ferro-columbium-tantalum, which are used for producing columbium stabilized stainless steels, are in short supply and are required for the defense program. These alloys are primarily used, NPA officials explained, in high combustion chambers and in the processing of certain chemicals, and not in consumer type goods such as homewares, refrigerators, automobiles and the like.

The order, NPA Order M - 3, provides:

(1) That production, distribution and use of ferro-columbium and ferro-columbium-tantalum be limited to "DO" defense rated orders which are reserved, under the NPA priorities system, to procurement by the Department of Defense and the Atomic Energy Commission.

(2) That the use of ferro-columbium bearing steels is prohibited in any application or process where ferro-columbium-tantalum bearing steels may be substituted, and, further, that the use of either of these alloys is prohibited where any other substitutes can be used.

Text of the order is attached.

REPORT ON KEENAN PROPERTIES

SPEARFISH, SOUTH DAKOTA.

The mining properties controlled by the Keenan interests embrace ninety four claims or approximately two thousand acres on Bear and Potato Creeks, near Spearfish, South Dakota.

These properties contain valuable placer deposits of tin, tungsten, columbium-tantalum and gold, which will be recovered by a gravel washing plant and mill circuit. The exploration and development of these properties by the Keenan interests started in 1947 and surveys were made through 1948 and 1949 which included test mining operations with a pilot plant and the perfection of a recovery method. The result from the test placer mining operations and reports from reputable mining engineers are sufficiently attractive to warrant the Keenan interests in opening up these properties for a commercial mining operation. This resume indicates the value of the proposed operations in supplying strategic and critical minerals.

All of the properties referred to are controlled by the Keenan interests under conventional mining leases, and on an advance royalty basis of $1,200.00 per annum. Leasehold inventory is $258,000.00, Keenan Properties inventory $75,000.00 .

Realizing the strategic importance of tin and columbium-tantalum, with the tungsten and gold in the placers and the commercial values in the lode claim properties, the Keenan interest consulted with The Dorr Company, Stamford, Connecticut, and Oscar N. Bribach, Chemist, of Aurora, Colorado, who have submitted respectively a proposal contract to design and construct a modern washing plant and mill circuit to recover and process high grade placer concentrates, as well as a recommended flow-sheet for the separation of the minerals in the concentrates.

The properties have available sufficient water, electric power within one half mile of the properties, and a good road road facility to the Chicago & North Western Railroad. These factors tend to make this a practical and profitable venture.

The Keenan interests are immediately prepared to mine the placer deposits on Bear Creek. The survey of the Bear Creek area indicates a total of approximately 670,000 cubic yards of gravel, or a gross recovery of 1,005 tons of concentrates. The surveys show that these concentrates assay 31.87% tin, 10% columbium-tantalum, 8-10% tungsten, and a minimum of 35¢ per cubic yard in gold.

Potato Creek survey shows approximately 400,000 cu. yds. or a recovery of 540 tons of concentrates containing 29.5% tin, 10% columbium-tantalum, 8-10% tungsten and a minimum of 35¢ per cubic yard in gold.

At $1.50 per pound for tin, $1.80 per pound combined Columbium-Tantalum, $38.50 per short ton unit of Tungsten and $35.00 per oz. Gold, the following estimates can be made:

The Bear Creek area will yield approximately 341 tons of tin concentrate valued at $1,023,000.00; approximately 214,000 pounds of columbium-tantalum at a minimum value of $385,200.00 and approximately 214,000 pounds of tungsten in the form of scheelite at $411,950.00 and gold at $234,500.00.

The Potato Creek area will yield approximately 590 lb. tin per ton of concentrates or 318,000 lbs. valued at $477,000.00; 108,000 lbs. of columbium-tantalum at $194,400.00; 108,000 lbs. of tungsten at $207,900.00, and $140,000.00 in gold.

The total estimated gross value of metals contained in the yardage described in the placer deposits, with no consideration for the probable and potential reserve available in the lode claims is as follows:

Tin @ 80% recoverable	$ 1,200,000.00
Columbium-Tantalum @ 80%. . .	463,680.00
Tungsten @ 80%	495,880.00
Gold @ 35¢ per cu. yd. . . .	374,500.00
Total. . .	$ 2,534,060.00

The placer mining operation is estimated to cost $0.295 per cubic yard as supported by detailed estimates attached. The total estimated cost of production is approximately $315,650.00.

KEENAN PROPERTIES
SPEARFISH, SOUTH DAKOTA

Subject: Critical Minerals for Defense, available through Keenan Properties, South Dakota.

Columbium

1. The shortage of columbium is now so critical that all government purchases are directed immediately to manufacturers and NONE is available for National Stockpile. This shortage is further accentuated by the need for ferro-columbium in jet airplanes. The contemplated consumption in this field will make an item which is unprocurable now by governmental agencies, virtually a museum rarety. Columbium must be available for jet engine turbine blades, tail pipes, exhaust cones and outer combustion chambers because no other materials now developed can equal the performance of columbium alloys in service at extremely high temperatures. The reasons for the present critical shortage are various. The principal one is the lessening quality of ore from Nigeria, which supplied 95% of the world supply in the past. When Nigerian columbite, formerly 95% columbium oxide, descended to 35% nearly half the previous world supply was cut off. Efforts in other countries to produce columbite have been disheartening.

The critical shortage of columbium has resulted in the expenditure of large sums of money in a most extraordinary amount of research and laboratory work, throughout the world, in an attempt to develop substitutes for the standard columbium alloys. This in turn has resulted in general recognition of the fact that all available columbium must be diverted to the high temperature alloys for essential applications.

The importance of columbium and its availability for the manufacture of jet engines cannot be minimized for it controls to large extent the limits of power and safety, speed and altitude of the whole aircraft. (The attached notes on conservation of columbium, by General Electric Co. Laboratories. The Royal Aircraft Establishment, Farnborough, England, and Atomic Energy applications are of interest.)

2. Keenan Properties 2000 acres of lode claims and 6½ miles of stream gravels are the only known domestic source of columbite ores, as certified by reliable engineering records. Pilot plant operations since 1948, engineering surveys and chemical assays now show an economic recovery method and sufficient quantities of columbite as well as tantalite, tin, and tungsten, to be of importance in the National Emergency. Production of these critical minerals can begin in March-April 1951, with no further exploration and development required and the following minerals made available for National Stockpile: 350,000 pounds of columbite; 1,116,000 pounds of tin; 16,000 short ton units of tungsten, all meeting requirements of government specifications. These amounts are contained in the surveyed stream gravels and do not include ores recoverable from the lode mining claims.

3. Keenan Properties, with nationally recognized engineers and chemists as consultants and production superintendents, require financial assistance from the government in order to produce the above metals for the National Defense Stockpile. A total of $100-115,000.00 (including $150,000.00 in heavy equipment immediately available through government warehouses; i.e. draglines, bulldozers, etc.) is required to assure production from Keenan Properties in early 1951. Offers to furnish the above amounts of mineral have been sent to General Services Administration and contracts, with a guaranteed loan under the Defense Production Act 1950, are requested at once in order that construction and assembly of specialized equipment may be completed during the winter months in preparation for production operations in March.

EXTRACTS FROM
METAL PROGRESS, NOVEMBER 1950
CONSERVATION OF COLUMBIUM

"West Lynn, Massachusetts

General Electric's experience has been primarily with type 347 (columbium) stainless steel. This was originally chosen because of slightly higher creep and rupture strength, superior welding characteristics using the atomic hydrogen process and lower susceptibility to intergranular corrosion in the Strauss test. With the shortage of ferro-columbium considerable effort has been made to replace columbium stabilized steel with the titanium grade (321). The chief disadvantage with type 321 is the difficulty it presents in welding with the atomic hydrogen process. The trouble with type 321 lies in the formation of a scum which makes atomic hydrogen welding slow, difficult and of poor appearance. Also, 321 has been difficult to produce with a surface quality comparable to 347 (Cb). This is of considerable importance in parts that are subject to fatigue stresses.

Another possible solution to the program to conserve columbium is the use of somewhat more available ferro-tantalum-columbium to stabilize austenitic stainless steel. Tests are in progress on several heats with varying ratios of columbium plus tantalum to carbon. The ratio of columbium plus tantalum to carbon has to be about 11 minimum for complete immunity to intergranular attack.

With the present critical shortage of ferro-columbium it is apparent that the available supply will be diverted to the high-temperature alloys which require the columbium to gain their high strength. This means that users of 347 (Cb) steel will have to choose an alternate in either 347 (Ta-Cb) or 321 (Ti).

W. E. Jones
Thomson Laboratories
General Electric Co.

Farnborough, England

Our practice has been due to the experience that the columbium-bearing alloys have remarkable casting and forging properties so that large masses can be produced with great reliability.

At every stage of engine and alloy development there has been a titanium-bearing material with properties equivalent to the columbium-bearing alloy, but these have not been used in large forgings because of production difficulties.... Generally, better and cleaner ingots are more readily produced with Columbium than with titanium.

The situation has been reached when columbium is being recognized for what it is - a relatively rare metal. It is likely to become progressively less readily available and even if available, its price must almost certainly increase substantially.

It would be a praiseworthy act of self-discipline if manufacturers could reach agreement in limiting the use of columbium to essential applications, and at the same time initiate the research, possibly on a cooperative basis, necessary for extending the use of substitute materials.

L. Rotherham
Head of Metallurgical Division
Royal Aircraft Establishment.

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ATOMIC ENERGY APPLICATIONS

(Columbium, in critical shortage for Jet engine manufacture, is also in demand for Atomic Energy use.)

Schenectady, New York.

In considering the merits of stainless steels and their many applications in the atomic energy field, there is at least one factor to be considered -- the scattering and absorption of neutrons by the material. These properties vary widely among the metals, and small amounts of an undesirable element in an alloy are deleterious enough so that a most detailed chemical analysis of the alloy is customary for their detection. For instance, the thermal neutron absorption of the basic ingredients and the three stablizing elements in stainless steel have the following relation (General Electric Chart of the Nuclides, 1950).

Iron	2.4
Chromium	2.9
Nickel	4.5
Titanium	5.8
Columbium . . .	1.2
Tantalum	21.0

The higher the value given above, the less suitable is the element for some applications in a nuclear reactor. Thus, depending on the particular reactor for which stabilized stainless steel is being considered, design factors may limit the kind and amount of stabilizing elements that are permissable.

L. L. Wyman
General Electric Co.
"Metal Progress" -
November 1950

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SUPPORTING REFERENCE DATA FROM AUTHENTIC SOURCES WHICH MAY BE VERIFIED.

"Referring to various published articles on this property, it is noted that in the Bureau of Mines Information Circular 7084 of July 1939, on Tantalum (Columbium) under the title 'Mining and Milling Methods and Costs of the Black Hills Tin Co., Tinton, South Dakota,' that they give certain information on costs, and on this (Keenan Properties) district in general and state that, in 1927 a bulldozer uncovered the first tantalite-columbite found in the Tinton area. This date is not correct.

"In the American Institute of Mining Engineers Transactions of May-February 1888-9, Vol. XVII. A complete report was made by Dr. Franklin R. Carpenter, President of the South Dakota School of Mines, Rapid City, which was part of his complete report on the 'Geology of the Black Hills.' This report mentions the finding of tin and refers specifically to Bear Gulch (Keenan Properties' 'Bear Creek.') In connection with this work he also identifies both tantalite and columbite. Considerable research work was done and discussion held on the presence in the Bear Gulch district of tantalum and columbium. Further, in 1889 an additional paper was given by Franklin Carpenter and W. P. Headden at the same meeting in New York, under the heading 'Notes on Influence of Columbite on Tin Assays.' A discussion was had showing, without question, the presence of columite in these ores of the Black Hills.

"Referring now to Bulletin 922T by Ward C. Smith and Lincoln R. Page, published by the U. S. Department of Interior, Geological Survey, complete information is given in regard to columbite-quartz-albite lenses, wherein they show columbite to be present in the Keenan Properties district, and also have taken up the study of the various formations in which columbite ore occurs, as well as tin.

"These citations are made in order to bring forward that there is nothing new in knowing that columbite and tin do exist in these placers, also tungsten, -- not only in the placers gravels but in the lode claims in the Tinton District of the Black Hills, at the center of which Keenan Properties' 6½ miles of placer gravel streams and 2000 acres of lode claims are located.

"We have received a copy of a report by W. C. Driskill, under the heading 'Report of Tin Bearing Placer Gravels of Bear and Potato Creeks, Tinton Area, Lawrence Co., South Dakota.' We are informed that Mr. Driskill, a placer engineer, being a graduate from the South Dakota School of Mines, and has spent many years in the Keenan Properties District. Accompanying his report are certain maps of the geological formations, and also certain maps of his sampling on Bear Creek and

Potato Creek. His comprehensive survey-report was made in accordance with best recognized engineering practices and gives a considerably greater tonnage than the tonnages indicated by the preliminary sampling done by the Bureau of Mines engineers in a few days. He has gone into the matter very exhaustively, and he outlines the cubic yardage in the Bear Creek placer and the Potato Creek placer in careful detail. It does appear that the survey and sampling which Mr. Driskill has taken, is very much more complete and thorough than the sampling which was done by the Bureau of Mines.

"It has developed on inquiry, and is covered by the sketch attached to the Bureau of Mines report, that the samples taken by the Bureau of Mines did not include any of the new work that was done by Keenan Properties during the fall of 1949.

"We have received a summation of the pounds that can be recovered from each of these placers as is predicated upon the above mentioned Driskill report.

"We have also received analysis certificates and a memo covering the work done by Oscar N. Bribach, 800 Dayton Street, Aurora, Colorado, a nationally recognized chemist on the recoveries of the various metals in this project. We have received data on the different metals per cubic yard on these properties. We have a photostat of the flow sheet showing what the mode of operation will be.

"Insofar as the company engineer's results and the results of the Bureau of Mines' engineers are at such divergence, it is stated:

"1. It does not appear from any information at hand the engineers who examined this property for the Department of Interior included a recognized Placer Engineer.

"2. It is recommended that the equipment that is in government control, which could be used on this property, be frozen for this job immediately.

"3. That the necessary work should be completed on the metallurgical end of this job, by the engineer Mr. Bribach, for the purpose of working out the detail of the mill flow sheet and method of separation, while the placer equipment is being assembled for production.

"4. It is suggested in order to insure design and installation of equipment for a practical operation that the proposal already submitted by The Dorr Co., Consulting Engineering Division,

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who are internationally known mining engineers, be accepted. This company has studied the past development engineering data, Driskill Survey and Bribach recommendations and is ready to correlate all work done and design a plant for economic operation. Mr. Walter W. Johnson, recognized Placer Engineer of San Francisco is available as Consultant and can, with the Dorr Co. aid in perfecting a successful production for the National Stockpile.

"5. That the engineers perfect the efficient method of operation of selective mining in order to get the greatest amount of columbite and tantalite and other strategic metals in the shortest time possible on a commercial basis.

"6. That the Consulting Engineers consult with a lode mining engineer to evaluate the lode deposits which are the source of the columbite, tantalite, tungsten and tin in the stream gravels. This matter should not be overlooked.

"7. That the offers of metals by Keenan Properties be contracted for, that the money be appropriated under the Defense Production Act 1950 for the purchase and assembling of the equipment to get this operation going on a practical basis immediately. That the total sum necessary be appropriated in readiness to carry the operation to its completion. As suggested, an experienced placer gravel engineer will be engaged by Keenan Properties to superintend the operation and to select the ground to be mined as outlined in the Driskill Survey.

"8. It should not be necessary for anyone to make a comment upon the great need of columite, tantalite, tungsten and tin from a domestic source, and no energy should be lost in accomplishing this desired result at once."

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The attached "Reference Data on Columbite and Tin, Keenan Properties, South Dakota" are additional citations from 1885 to 1949 and appears to establish without question, the presence of tin, columbium, tantalum and other strategic metals in the area now controlled by Keenan Properties.

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An actual record of production of tantalum-columbium concentrates is shown in Taggart's "Mineral Dressing" 1948, pp. 2-221, where 78,565 pounds ranging from 38.7 to 57% quintoxides were produced from properties, part of which are now controlled by Keenan Properties, the remainder immediately adjoining Bear Creek.

Records show that two placer mining engineers, Mr. Earl Amundson of Deadwood, South Dakota and Mr. Walter Erickson of Anchorage, Alaska, supervised the construction of a pilot plant on Keenan Properties on September 1948, and the U. S. Bureau of Mines Mineral Year Book 1948 states that about 3000 pounds of tin concentrates were produced in 1948, which contained tin, tungsten, gold, tantalum and columbium. In 1949 this pilot plant was improved, and the plant treated 5,104 cubic yards of gravel from Potato Creek, in an area that had been previously placered for gold. 5,445 pounds of concentrates carrying tin, tungsten, columbium-tantalum were recovered and 57 ounces of gold sold. The assays of these concentrates were in the same average percentage of metals as those in the samples certified in the Driskill report and show a recovery of $1.55 per cubic yard at prices as of June 1950.

From March 1948 to December 1950 approximately $85,000.00 has been expended by Keenan Properties, on exploration and development, roads, improvements and labor. Leasehold inventory including mill, buildings, and machinery is approximately $280,000.00.

The greater tonnages and difference in values can well be accounted for by the thorough nature of the Driskill Survey compared with the fact that in early July 1949, the Preliminary Bureau Mines sample diggings was checked by two capable mining men and evidence indicated that at no place were sample excavations made to bedrock. This absence of samples near bedrock explains the lower values shown in the Bureau of Mines report. In addition, the Bureau of Mines report clearly indicates that samples taken from "Spillage" at the site of Keenan Properties 1948 pilot plant operation, could only have been taken from tailings, where values had already been removed. This would certainly lower the average values of the report. The short time spent by the Bureau of Mines engineers, with no machinery and in territory unknown to them, naturally precludes a thorough sampling as compared with the months spent by Driskill's crew using bulldozers and machinery.

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Reference Data on Columbium and Tin

Keenan Properties, South Dakota

In addition to the technical and engineering data resulting from Keenan Properties exploration, development, and pilot plant tests, from September, 1947, to date, including placer surveys on Bear and Potato Creeks and production analysis reports, the following references, published by U. S. Bureau of Mines, the U. S. Geological Survey and the Congressional "Tin Investigation" Report HR.404 and HR.71 dated 1934-35, 73rd and 74th Congress, are submitted.

In view of the fact that Keenan Properties lode claims are located within the area referred to and a part of the above Bureau of Mines, Geological Survey and Tin Investigation Report, and since the best Geologists report that the pegmatite dikes in the district are 2-3 billion years old, and that erosion has taken place to a depth of 2-3000 feet, it is reasonable that the streams, old and new, have been repositories for the values contained in the eroded materials.

In support of Keenan Properties placer survey, assays reports and pilot test operation data, the following references are made to the documented Government evidence of the established presence of critical and strategic minerals which Keenan Properties desire to produce for the National Defense.

1. Geological Survey Bulletin 922-T
   Tin-Bearing Pegmatites of the Tinton District, Lawrence Co., South Dakota.

   Page 597: Describes Fansteel Metallurgical Co. operations on Giant Volney claim, on Tantalum Hill. "The ore mineral is columbite, an iron and manganese Columbate-tantalate."

   Page 599: "....and columbite of direct economic interest."

   Page 606: "....columbite-quartz-albite lenses."

   Page 607: "Columbite accompanies the cassiterite."

Page 610: "Irregular lenses of columbite-quartz-albite rock containing clusters of columbite crystals as much as 3 inches long....and that masses of columbite replace that rock as well as microcline and amblygonite."

Page 613: "Cassiterite, columbite, and amblygonite have been mined from the Tinton pegmatites."

Page 616: "Cassiterite and columbite are closely associated in all the Rough and Ready Ore bodies and also in dikes as far distant as the Jersey Claim 1½ miles to the south.....Thin sections of the tin ore show that columbite is present not only as large grains identifiable in hard specimens but also as innumerable tiny specks...."

Page 618: "Reserves -- The only ore bodies in the district that have been sufficiently tested to establish their grade and size are in the Rough and Ready mine..... The results of sampling and exploration conducted by the Bureau of Mines indicate a reserve above the 135-foot level of about 68,000 tons of tin-bearing pegmatite containing an average of 6.33 pounds of tin to the ton."

Page 627: "....assays indicate 16.4 pounds of tin to the ton...Grains of cassiterite as much as an inch in diameter are plentiful in the pegmatite."

Further reference is made to columbite crystals on ten other pages of the above Bulletin, in which the writers state: "These potential ore bodies have irregular boundaries...It seems impossible, therefore, to predict the dimensions of an ore body or its probable grade in advance of exploration."

2. U. S. Bureau of Mines Report of Investigations. RI4484 Jahn and Pesonen. July, 1949.

Page 7: "Lenses of columbite-quartz-albite rock containing clusters of columbite crystals have been found in the dike. It also occurs as a filling in cracks in the spodumene-quartz-albite."

3. "Tin Investigation" Report, HR404 and HR71, 1934-35 made by the House Sub Committee on Foreign Affairs Pages 234 to 235: "The upper horizon is fully exposed and exhaustive sampling shows 2,100,000 pounds of metallic tin. 260,000 pounds of metallic tin have been produced from this horizon. Projection of this horizon to diamond drill depth adds 14,000,000 pounds of probable tin and to 1,000 feet depth another 24,000,000 pounds of possible tin.

" Three other equally promising ore bodies are explored with several hundred feet of underground drives, surface trenches, shallow shafts and acres of surface stripping...the probable and possible ore in these bodies adds up to 90,000,000 pounds of metallic tin.

" The total tonnage of these explored deposits is 65,000 tons of metallic tin.

" The reason this deposit has not been in production is that inherent in all large but marginal ore deposits, the burden of mine development and treatment problems is beyond usual capital resources. For example, in the expenditure of more than a million dollars on these properties, no man with prior experience in tin has ever been in authority...TIN, CASSITERITE, (STREAM TIN) IS ONE OF THE CONSTITUENTS OF THE PLACER GRAVELS, PARTICULARLY IN BEAR GULCH, WHERE IT OCCURS IN CONSIDERABLE QUANTITY....."

References to Tin and Columbite in
Black Hills of South Dakota

Dr. Franklin R. Carpenter, Dean, Dakota School of Mines, Rapid City. 1889, In Transactions of American Institute of Mining Engineers on "Ore Deposits of the Black Hills of Dakota".

Page 571 "Two kinds of placers, tin and gold, are found. The placers are also of different ages, quarternary and Recent."

p.588-9 "The known area of tin bearing rocks extends into the Nigger Hill District... the tin veins are gold-bearing."

p.590 "The tin area of the Hills is naturally divided into two localities, the Nigger Hill or Bear Gulch district and the Harney Peak or Custer City district."

p.593 "Analysis, Dakota School of Mines, by Dr. W.P. Headden:

Tantalic acid	18.20%
Columbic acid	64.09%
Ferrous oxide	11.21
Manganous oxide	7.07
Stannic oxide	o.10
Calcic oxide	0.21

sp. gravity 5.89 (5 other samples sp.gr. 5.89 to 6.12)

p.596 "Analysis of Stream Tin: Dr.W.P.Headden

No.1. Nigger Hill Stream Tin
Stannic oxide 92.60% (tin 72.84%)
No.2. Nigger Hill Stream Tin
Stannic oxide 93.00%)tin 73.21%)
Iron 2.16
Insoluble 3.96
sp.gravity of several samples 7.

p.596 "Hand samples containing from 25 to 50 percent of black tin can be readily selected"

p.597 "Professor William p.Blake suggests that it will probably be found advisable to send to the mill for treatment all rock carrying per ton 10 pounds of cassiterite and upwards. If this be done, I estimate 2% cassiterite as probable average of the tin ore treated.
William P.Blake. Transactions AIME 1885, page 697.

" I found a very remarkable mass of columbite or tantalite which must weigh over 2000 pounds. It is the only body of mineral in that part of the vein and is not in close association with the cassiterite. One charge of giant powder broke it into several fragments, 3 or 4 of which were too heavy for a man to lift."

CONTRACT DATA

As a result of the engineering surveys, assays, placer report and test pilot plant operations, the following is an estimate of Keenan Properties placer reserves of critical metals (without consideration of the large lode-claims deposit of these same metals.)

Tin.....	1,116,000 lbs.
Columbium-Tantalum.....	350,000 lbs.
Tungsten (WO3).....	320,000 lbs.

The above recoverable amounts of metals are available for contract with the Department of Defense, and have been offered to the Emergency Procurement Service, General Services Administration, January 9th, 1951.

The gold is not included in the Contract offer because the percentages of "free" gold and the gold recovered by analgamation cannot be determined until production is effected.

YARDAGE & VALUES DATA - BEAR & POTATO CREEKS

Bear Creek

Yardage:	670,000 cubic yards @	0.815 lbs. Sn per cu.yd.	
		0.256 " Cb-Ta "	
		0.256 " WO_3 "	
		0.010 ozs. Au "	
Values:	0.815 lbs. Sn @ $1.50 lb.	$1.222 per cu. yd.	
	0.256 " Cb-Ta @ $1.80 lb.	.460 " "	
	0.256 " WO_3 @ $38.50 unit	.491 " "	
	0.010 ozs. Au @ $35.00 oz.	.350 " "	
Gross Total Value		$2.523 per cu. yd.	

Potato Creek

Yardage:	400,000 cu. yds. @	0.637 lbs. Sn per cu.yd.	
		0.216 " Cb-Ta "	
		0.216 " WO_3 "	
		0.010 ozs. Au "	
Values:	0.637 lbs. Sn @ $1.50 lb.	$0.955 per cu.yd.	
	0.216 " Cb-Ta @ $1.80 lb.	.388 " "	
	0.216 " WO_3 @ $38.50 unit	.413 " "	
	0.010 ozs. Au @ $35.00 oz.	.350 " "	
Gross Total Value		$2.106 per cu. yd.	

Bear Creek based on 3.2 lbs. concentrates produced per cu. yd., containing 31.87% Sn, 10% Cb-Ta, 10% WO_3, recovering 35¢ Au per cu. yd. and 80% of contained values in Tin, Columbium-Tantalum and Tungsten.

Potato Creek based on 2.7 lbs. concentrates produced per cu. yd., containing 29.5% Sn, 10% Cb-Ta, 10% WO_3, recovering 35¢ Au per cu. yd., and 80% of contained values in Tin, Columbium-Tantalum and Tungsten.

178710 7017

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

WASHINGTON 25

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS

IN YOUR REPLY
REFER TO FILE

9.7

November 30, 1950.

Emergency Procurement Service,
(Attn. Mr. T. S. Rogers),
7th and D Streets S. W.,
Washington, D. C.

Sirs:

The following minerals were identified in the sample submitted, as requested by telephone on November 29th. No attempt was made to give a quantitative estimate of the individual minerals present.

Gold in considerable amounts.

Magnetic material which consisted of some magnetite and other iron-bearing minerals.

Garnet

Topaz

Cassiterite in appreciable amounts.

Columbite. This mineral was identified by X-ray diffraction.

Other unidentified minerals are present in varying amounts.

Very truly yours,

A. Van Valkenburg Jr.

A. Van Valkenburg, Jr.,
Geologist.

OSCAR N. BRIBACH

800 Dayton St.,
Aurora, Colorado.
November 22, 1949.

Samples assayed for Keenan Properties

Description	Oz. per ton Gold	% Earth Acids	% WO_3	% Sn	Wt. sample grams	Milligrams Gold
S-13	196.70	3.6	3.2	25.8	195	1314.00
S-14	115.49	7.4	3.5	33.6	107	425.3
S-15	48.81	8.8	3.1	38.2	253	423.3
S-16	7.20	9.9	0.8	49.9	149	36.8
S-17/18	66.82	3.7	1.8	40.0	219	501.8
S-20	4.87	2.9	2.1	24.5	91	15.2
S-21	4.13	6.7	0.1	53.2	55	7.8
S-22/23	3.40	6.7	1.1	45.3	136	15.9
S-24	28.08	4.4	0.1	33.3	66	63.5
S-25	0.86	5.5	2.9	23.4	83	2.5
S-26	5.10	5.4	3.2	22.8	178	31.1
S-28	26.79	12.7	1.5	35.4	253	233.4
S-29	2.84	7.0	1.4	43.2	300	29.3
S-30	1.48	8.8	1.9	32.3	130	6.6
S-31	155.82	12.9	2.7	20.9	161	860.2
S-32	245.93	7.1	2.6	30.2	168	1416.9
S-33	22.34	4.3	1.6	24.1	147	112.6
S-34	8.31	8.7	1.7	34.2	139	39.6
S-35	54.08	7.6	1.9	29.7	416	757.0
S-36	17.10	8.0	2.2	30.3	74	43.5
S-37/38	1.24	8.9	1.9	26.1	180	7.7
S-39	26.86	8.5	1.9	23.2	102	93.9

S - Bear Creek Sample.
S-25- indicates number of section in Bear Creek represented by sample.

Earth Acids - Ta_2O_5-Nb_2O_5

(Copied from Original) (signed) Oscar N. Bribach.

17

OSCAR N. BRIBACH

800 Dayton St.
Aurora, Colorado
November 30th, 1949

We Certify that samples assayed for Keenan Properties
Gave the following Results:

Description	Oz. per ton Gold	% Earth Acids	% WO_3	% Sn	Wt. sample grams	Milligrams Gold
P-1	15.61	7.6	2.0	28.1	89	47.64
P-2	19.89	13.1	4.4	39.6	144	98.29
P-3	14.78	7.4	1.9	32.8	82	41.51
P-4	52.24	8.0	8.5	34.1	104	186.53
P-5	51.70	6.3	0.3	27.4	33	58.43
P-6	85.45	5.6	0.8	22.7	84	246.10
P-7	5.18	6.5	8.0	31.5	73	12.96
P-8	253.83	6.6	3.3	21.0	78	677.73
P-9	31.84	9.1	1.9	37.5	83	90.76
P-10	3.17	11.9	2.9	39.7	169	18.39
P-11/12	11.81	7.0	0.1	27.0	127	51.38
P-13	14.27	2.9	1.1	12.6	66	32.26
P-14	9.58	6.5	7.0	31.9	88	28.96
B-21	1.49	8.0	8.1	31.9	185	9.54
B-22	0.04	7.4	8.0	23.4	94	0.13
B-23	0.60	7.6	3.7	27.3	173	3.56
B-24	2.49	7.0	5.2	25.0	127	10.84
B-25	9.05	7.7	8.7	19.9	300	93.18
B-26	0.43	7.0	7.9	28.2	200	2.95
B-27	0.60	6.7	6.7	24.7	152	3.14
B-28	0.45	6.6	6.9	25.1	151	2.34

P - Potato Creek Sample
B - Upper Beaver Cr. Sample
P-8 indicates number of Section in Potato Creek represented by this sample.

Earth Acids - Ta_2O_5-Cb_2O_5

(Copied from Original) (signed) Oscar N. Bribach.

18

OSCAR N. BRIBACH

800 Dayton St,
Aurora, Colorado.
December 5th. 1949

We Certify that samples Assayed for Keenan Properties
Gave the Following Results:

Description	Oz. per ton Gold	% Tin	% WO_3	% Earth Acids	Remarks
X-1	1.95	50.0	2.0	7.9	Rougher Jig product 10/26/49
X-2	10.15	54.9	3.9	7.7	Denver jig product from X-1
X-3	0.05	37.2	11.0	10.8	Rougher jig basket 11/1/49
X-4	13.48	54.2	4.0	9.9	375 lbs from 2650 lbs rougher
X-5	2.81	52.4	3.6	10.2	Denver jig product including 2501bs rougher not amalgamated.
X-6	13.94	4.9	1.6	6.5	Represents 4350 lbs rougher Week of 9/24 from 470 yards.
X-7	4.86	50.7	1.4	7.9	Direct rougher jig product
X-8	0.33	44.5	2.0	10.0	315 lbs from 2350 rougher recovered from 84 yards 10/31/49
X-9	4.15	39.2	3.3	9.2	Denver jig #1 hutch recovered from 3500 lbs rougher 11/12/49
X-10	0.05	5.1	0.1	0.3	Denver jig #2 hutch recovered from above rougher (X-9)
X-11	6.49	10.4	0.3	6.3	Represents 3500 lbs wet rougher (X-9 & 10) from 165 cu yards
X-12	0.002	0.09	0.1	0.4	Tailings Denver jig X-9 & 10
X-13	0/002	0.007	0.2	0.2	Tailings from mill dump
X-14	0.07	0.5	0.1	1.1	Random Talc sample 11/10
X-15	0.05	24.3	1.5	8.6	Plus ¼" rougher product
X-16	0.76	2.9	nil	2.3	Tailings Denver jig 8/1-8/19/49
X-19	0.12	27.2	7.3	11.5	Plus ¼" minus ½" rougher jig basket bed.

X - Pilot plant production sample.
Samples underlined(X-5) indicates incomplete gold recovery.
Tailings loss due to faulty jig operation.

Copied from original Certification, but excluding weight of sample and milligrams gold because of space limitations.

(signed) Oscar N. Bribach.

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Sheet 2

Daily Production Costs

Administration	$ 50.00
3 Trommel bosses @ 2.00 hr.	48.00
3 Dragline operators @ 1.75 hr.	42.00
3 Cat operators @ 1.75 hr.	42.00
3 Truck-mechanics @ 1.50 hr.	36.00
4 men contingency crew @ 1.25	40.00
Supplies	75.00
Contingencies	75.00
Fuel	85.00
Overtime	35.15
Trucking to mill	12.00
Payroll, Ins. & Tax	19.68
Eng. Superintendant	25.00
Assayer	15.00
1 Mill Foreman @ $1.75 hr.	15.00
1 Mill hand @ $1.25 hr.	10.00
Mill Supplies	50.00
Mill Contingencies	25.00
Mill payroll, Ins. & Tax	2.64
Trucking to Rail head.	6.95
	$ 708.42

2400 Cu. yds. @ $708.42 = $ 0.295 per cu. yard.

(Previous 1950 estimates show $0.21 per cu. yd., above increase due to increased labor costs, etc.)

20.

Sheet 1 — Cost & Profit data. Placer Operations Flow-sheet

On basis of 3,000 cu. yd. capacity* per 24 hours (2400 cu.yds. @80% efficiency) Producing 3.2 lbs. concentrate per cu.yd. gravel, @31.87% Sn, 10% Cb-Ta, 10% WO_3, 35¢ Au per cubic yard, and recovering 80% of contained values. (Average operation 180 days per annum.)

1.	7,680 lbs. concentrate @ $0.757 per lb.		$5,819.00
2.	Production Costs (See sheet 2)	$708.42	
3.	Separation Costs @ $0.40 per lb.	1,258.00	
	Amortization ($350,000.00 over 3 yrs.)	648.15	
	Royalties @ 12.5%	727.27	
4.	Depreciation & Reserve Fund	158.74	
	Contingencies 2%	116.38	
	Exploration & Development 3%	174.57	
5.	Overhead Service to contracts & Sales	652.07	
	Total		$ 4,443.60
	Net Profit per 24 hours		$ 1,375.40
	Net per 30 days		$ 41,262.00
	Net per 180 days		$ 247,572.00

* Based on Lima-Hamilton Corp. data for #802 dragline equipment
1. Based on Sn, @ $1.50 lb., Cb-Ta @ $1.80, WO_3 @ $38.50 unit
2. Increase over previously estimated 21¢ cost due to increased cost of labor
3. 40¢ per lb. contained oxides
4. $200,000 over 7 years
5. Salaries, consultant fees, legal.

REPORT ON THE TIN-BEARING PLACER GRAVELS OF BEAR AND POTATO CREEKS, TINTON AREA, LAWRENCE COUNTY, SOUTH DAKOTA

by

W. C. Driskill

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REPORT OF THE TIN-BEARING PLACER GRAVELS OF BEAR AND POTATO CREEKS, TINTON AREA, LAWRENCE COUNTY, SOUTH DAKOTA

by

W. C. Driskill

INTRODUCTION

This report on the placer gravels of Bear and Potato creeks is for the purpose of recording the yardages and values as found by the writer and his associates during September and October of 1949.

With the exception of the 12-year period from 1931 to 1943, during which the writer tested, examined, and in some cases worked the placers of Sand Creek, Mallory Gulch, Bear Creek, Potato Creek, and Iron Creek, no attempt has been made to recover the valuable concentrates known to be held in these stream gravels until Keenan Properties began their tests and operations in the fall of 1948.

While the report deals entirely with the Bear and Potato Creek placers, including part of the Beaver Creek placer grounds, the 12 years of previous examination and working are naturally considered. To undertake a thorough examination of these two streams and their adjoining bars and ledges in a few weeks would result in information lacking necessary detail.

In this area, approximately ten by four miles in extent, there are approximately 3 million cubic yards of alluvial gravel in the creek valleys, showing tin, gold, tungsten, and columbium-tantalum. Part of this yardage is in shallows and sometimes narrow valleys, but at least 2 million cubic yards are in broad valleys 6 to 30 feet deep. There are also several known high channels of pre-Tertiary time which carry values. I estimate these high bars to carry over 4 million cubic yards.

The areas covered in this report are accessible. To conduct the recent testing on Bear Creek a caterpillar was used, building a passable road from 70 Flats to above Nigger Gulch. Good Forest Reserve roads are close to Potato Creek and to Keenan Properties mill site (leased from Dakota Tin and Gold Company) and their present placer operations in Potato Creek.

Boulders over 2 feet are uncommon except in isolated parts of Bear Creek and in small areas of Potato Creek. The percentage of minus half inch is plus 50 percent. The gravel washes easily with no sticky clay to speak of, particularly in Bear Creek. Since the tin and gold are generally coarse there is practically no slime loss. Bedrock varies from soft, decomposed porphyry and schist to hard, indurated sandstone and silicified dikes. Storage and conservation of spring run off is essential for any washing operation. Rainfall is light but there are heavy winter snows resulting in high spring levels, which can be stored by use of adequate dams. Operations are seasonal, six to seven months being an average season. Elevation is five to six thousand feet. There is a good camp and mill buildings on Keenan Properties, approximately a mile and a half from Tinton.

The Tinton pegmatites were intruded into the pre-Cambrian schists in Cambrian time. It is estimated that two or three thousand feet of depth has since been eroded. The Tinton pegmatites show good tin, tungsten, columbite-tantalite and gold values in what remains of these pegmatites. The erosion resulted in an accumulation of heavy minerals in the valleys which drained the pegmatite dikes. In Tertiary time, the country was upset by intrusions of monzonite porphyry, cutting across the old channels and interrupting them. In time, the drainage was re-established and there resulted a series of basins above where the creeks broke through the intrusive dikes. These basins filled with gravel and formed collecting areas where the heavy minerals collected. Many of these basins remain untouched.

BEAR CREEK PLACER

Bear Creek has its origin around the Nigger Hill pegmatite at Tinton, South Dakota. It goes past several tin and columbite-tantalite-bearing pegmatites for approximately a mile before it reaches Nigger Gulch at Bear Town. There is considerable scheelite in the placers at this point (Section 35, Map 1). Tests in 1942 showed 1/2 pound of tin per cubic yard above Bear Town and 1 pound metallic tin per cubic yard below Bear Town. Scheelite in the concentrates ran well over 10 percent. Water flow varies from 1,500 gallons per minute in the spring, to 300 gallons in the middle of August.

Approximately a third of a mile downstream from Nigger Gulch, another unnamed gulch enters Bear Creek from the west. It originates in the northern part of Nigger Hill and carries tin and gold. Where it enters Bear Creek (Section 32, map 1), tests indicate extremely high gold values per cubic yard and metallic tin at approximately 1 pound per cubic yard. These earlier tests did not include bedrock run through.

At the head of every one of the small gulches in this area there seems to be thin gravel, usually springs originate there and the muck and overburden is generally to a depth of 10 feet. Centennial Gulch runs past several tin-bearing pegmatites and carries both gold and tin. As with Nigger Gulch, it is steep and narrow and can be most practically worked with a small unit.

Two test trenches dug in 1942 just across Bear Creek above Centennial, produced $200.00 in gold and 200 pounds of tin concentrate, and $100.00 and 400 pounds of tin concentrate (65 percent metallic tin) respectively. Samples taken from this section during October 1949 show the same or higher values (Section 31, map 1). The average here is $3.00 in gold per cubic yard, 1 pound of tin and 1/4 pound columbite-tantalite.

Two Bit Gulch (Section 27, map 1) is a small, narrow gulch similar to Nigger and Centennial gulches. It carries columbite-tantalite as well as tin in the concentrates. There seems to be little scheelite at this point. Below Two Bit, Bear Creek again widens out into another basin (Section 26) in which we also ran trenches during 1941 and 1942. This particular basin carries approximately 30,000 cubic yards of workable gravel averaging 35 cents in gold and 1 pound of metallic tin in concentrates carrying 10 percent columbite-tantalite.

Immediately below this basin is a bottleneck and another large basin (Section 24, map 1). From this point below the log cabin shown on map 1, to Connor's Rock, the gravel gets deeper rapidly, averaging 25 cents per yard in gold as far as Connor's Rock. Below this rock the gravel was too deep even for the old timers to work. Little of this area had ever been touched until the 1949 survey.

On the west side of Bear Creek, adjoining Wyoming Gulch, are large, high bars formed by the bend in Bear Creek around Connor's Rock (Section 18, map 1). From Connor's Rock to Seventy Flats, with an average working width of 200 feet, an average depth of 12 feet (in some instances 20 feet), and a distance of over 3,000 feet, this represents approximately 270,000 cubic yards, to which should be added approximately 30,000 cubic yards in high bars adjoining. Taking in all the gravel in upper Bear Creek, approximately 670,000 cubic yards, the Sawmill Creek gravel (approximately 170,000 cubic yards) we have a conservative total of 845,000 cubic yards of workable gravel.

The upper Bear Creek stream area only, approximately 670,000 cubic yards, was tested by pits and trenches during September-October 1949. (See table 1). The writer estimates that approximately 635,000 pounds of metallic tin are recoverable from this area, exclusive of an estimated conservative 30,000

pounds contained in adjoining high bars. In addition to the tin, approximately 215,000 pounds of columbite-tantalite and 210,000 pounds of scheelite (WO_3) are recoverable.

POTATO CREEK PLACER

Potato Creek, long ago, was a part of Beaver Creek, with Bear Creek flowing into it where there is a dip in the road above the turnoff to the Dakota Tin & Gold mill (now leased to Keenan Properties). This original Potato River had a considerably larger flow as attested by the depth of gravel and large boulders in the channel. The present Potato Creek originates in springs three-quarters of a mile south of the mill buildings on the Homeward Bound claim. At this mill Potato Creek is approximately 400 feet higher than Bear Creek, over the ridge. It goes past an old gravel bar, originally Bear River, then makes a right-angle turn to the northeast past the mill, passes through a narrow gorge, above which is the present pilot washing plant operated by Keenan Properties and enters a small basin of Johnny Perrett's old ground. Here very coarse gold is found. This seems to be true wherever present channels are in close proximity to the old River channels, such as Two Bit Gulch and Iron Creek.

A quarter mile below Perrett's old ground is a large basin which averages 3/4 pound metallic tin per cubic yard and 60 cents in gold. The ground situated in Section 10-13, Map 2, has several side gulches - Pearl, Hardscrabble, Hardpan, and Tenderfoot, all of which run up into the ancient river channel and all of which carry gold, tin, columbite-tantalite, scheelite and, in Tenderfoot, barites as well. There is a total of 32,000 cubic yards, not including the old River channel on the west side, on this property.

Below section 10 gravel values are estimated to be the same as above. Here, Potato Creek makes a sharp swing eastward after passing through a

narrow gorge (Section 8). Bank samples taken here carry visible coarse gold. These placers are estimated to contain 35,000 cubic yards of gravel with tin values as above but with higher gold and columbite-tantalite values. At Section 4 the Placer Survey 392 begins.

During the recent examination in October, this lower portion of Potato Creek showed more tin and gold than had been estimated during my earlier, preliminary tests. Values from Section 4 to the junction of Potato and Beaver creeks show approximately 65 cents in gold per cubic yard and one pound of tin in concentrates containing columbite-tantalite and scheelite. Three out of every six pans showed gold colors, with considerable scheelite in every one.

In the deeper gravels of Beaver Creek (Sections 20 to 28, map 2) there has been little previous placering done. Thirteen pans from the spoil of three old test pits were washed and assayed 0.44 pound tin and 26.2 cents gold per cubic yard. No bedrock samples were taken because of high water levels resulting from early snows.

The values contained in the old River channel are unknown. However, these high bars should turn out to be highly profitable providing the overburden can be economically stripped. On the ridge east of Potato Creek, south of Perrett's Section 14-15, there is close to 800,000 cubic yards of gravel; west of this section there appears to be 10,000 cubic yards. West of Sections 10 to 12, map 2, is the remaining gravel running to Two Bit gulch, approximately 200,000 cubic yards. In all there is a total of approximately 1,010,000 cubic yards of gravel in the old River channel.

Exclusive of adjoining high bars, previously tested by the writer, the Potato Creek placer gravels from Sections 1 to 15 carry approximately 320,000 pounds of metallic tin, 110,000 pounds of columbite-tantalite and conservatively

125,000 pounds of scheelite in the form of (WO_3). In view of the favorable recovery ratios in gold as produced by Keenan Properties pilot plant in gravel previously estimated to contain approximately 60 cents gold per cubic yard, a minimum recovery of 60 cents per cubic yard for Potato Creek can be anticipated.

SAMPLING AND RECOVERY DATA

During September and October 1949, 50 test trenches and 49 test holes or pits were dug in the Bear and Potato Creek areas. Samples were cut only in the walls of these excavated pits and trenches.

Vertical channel cuts 12 inches wide and 8 inches deep were made from top to bottom of all pits and trenches. These cuts were spaced at 6-foot intervals and weight of gravel averaged 40 pounds per linear foot of channel. The gravel was collected on canvas and alternate shovels from each channel pile was taken for sample. The final sample thus obtained for each pit or trench was then mixed and quartered by shovel, weighed, panned down to concentrate for analysis and sacked for shipment. A total of 1,859 feet of channel cuts were made which after quartering produced 9,316 pounds of sample for panning to concentrate. Approximately 12.25 pounds of concentrate was recovered and shipped for analysis.

A rocker was used but later discarded as a means of cleaning the samples since values were found in the tailings after a second run through the rocker. Samples were panned down to a concentrate which most nearly approached the grade produced by the present washing plant now operating in Potato Creek. Panning was favored because of the wide range in size of material, minus 200 mesh, recovered by screen test, to extremely coarse material as represented by the columbite-tantalite nugget panned above Two Bit Gulch, Section 28, map 1, which weighed 51.5 grams and measured 1-1/2 inches in length.

Examination and test of the Bear and Potato Creek placer gravels, using hand panning to produce concentrates, at the same time that Keenan Properties were operating their pilot washing plant on Potato Creek, afforded the writer an opportunity to compare recovery efficiencies.

The efficiency of a dozer-dragline fed revolving trommel, combined with Pan American Placer Jigs, as used in Potato Creek by Keenan Properties appears to be considerably higher than hand panning, having the advantage of larger capacity and better ability to handle the values immediately above and on bedrock.

From my personal observation of the above pilot washing plant, it appears that the use of Pan American Placer jigs as adapted by Keenan Properties is the most practical and efficient recovery method for the Bear and Potato Creek placers.

While much of the Potato Creek placers and part of upper Bear Creek have been worked by hand for gold, the recovery of extremely high gold values during the recent test, is believed to be the result of proper use of bull-dozer equipment in reaching and exposing the decomposed schist and prophyry bedrock in areas difficult for hand operation and sluice box methods. The 425,000 cubic yards of Bear Creek, from Section 13 to Section 20, with deeper gravel, while difficult for hand placer operations, offers no obstacles for modern machinery and methods. Much of the gravel between the above sections is estimated by the writer to carry values upwards of $3.00 per cubic yard.

Table 1. - Test, Sample and Analysis Data, Bear Creek Placer Survey, September 1949

Section	No. and type of excavation	Channel cuts feet	Sample weights: Panned Pounds	Sample weights: Concentrate Grams	Analysis: Percent Sn	Analysis: Percent WO_3	Analysis: Percent Cb_2O_5 Ta_2O_5	Analysis: Oz. per sht.tn. Au	Remarks
13 13	1 trench 1 pit	42) 20)	300	195	25.8	3.2	3.6	196.70	Coarse concentrate; bedrock sampled
14	2 pits	32	155	107	33.6	3.5	7.4	115.49	Water on br.
15	2 trench-	65	325	253	38.2	3.1	8.8	48.81	Water on br.
16	2 pits	30	160	149	49.9	.85	9.9	7.20	Br. sample
17 18	1 trench 1 pit	35))	180	219	40.0	1.8	3.7	66.82	Br. sample
19	1 trench	40	280	sample destroyed					nbr sample
20 20	2 trench 2 pits	39))	200	91	24.5	2.1	2.9	4.87	Br. sample nbr sample
21	1 trench	26	135	55	53.2	.1	6.7	4.13	Br. sample
22 23	1 pit 1 pit	18))	90	136	45.3	1.1	6.7	3.40	Br. sample Br. sample
24	2 trench	22	110	66	33.3	.4	4.4	28.08	nbr. sample
25 25	1 trench 1 pit	40)	200	83	23.4	2.9	5.5	.86	nbr. sample nbr. sample
26 26	2 trench 1 pit	42) 16)	285	178	22.8	3.2	5.4	5.10	Br. sample nbr. sample
27	1 trench	28	150	sample destroyed					Br. sample
28	2 pits	22	100	253	35.4	1.5	12.7	26.79	Cb-Ta nugget 51.5 grams
29	1 trench	21	105	300	43.2	1.4	7.0	2.84	nbr. sample, talc ledge
30	2 pits	40	200	130	32.3	1.9	8.8	1.48	1st talc ledge exposed
31	2 trench	65	330	161	20.9	2.7	12.9	155.82	Very coarse gold br.
32	2 pits	44	220	168	30.2	2.6	9.1	245.93	Coarse visible gold br.
33 33	1 pit 2 trench	41))	205	147	24.1	1.6	4.3	22.34	Br. sample
34	1 trench	36	180	139	34.2	1.7	8.7	8.31	Br. sample
35 35	4 trench 1 pit	68) 12)	400	416	29.7	1.9	7.6	53.08	Coarse material Visible gold
36	1 trench	40	190	74	30.3	2.2	8.0	17.10	Br. sample
37 38	2 trench 1 pit	55) 11)	340	180	26.1	1.9	8.9	1.24	Br. sample Shallow gravel
39	2 trench	60	175	102	23.2	1.9	8.5	28.86	Br. sample

Br. - bedrock sample
nbr. - no bedrock sample taken

See map 3 for estimated yardage and recovery values.

Table 2. - Test, Sample and Analysis Data, Potato Creek Placer, October 1949

Section	No. and type of excavation	Channel cuts feet	Sample lots: Panned Pounds	Sample lots: Concentrate Grams	Analysis: Percent Sn	Analysis: Percent WO_3	Analysis: Percent Cb & Ta_2O_5	Analysis: Oz. per sht.tn. Au	Remarks
1	2 trench	40	200	89	28.1	2.0	7.6	15.61	Br. sample
2	2 trench	65)	400	144	39.6	4.4	13.1	19.89	Br. sample
2	1 pit	15)							nbr. sample
3	1 trench	25	120	82	32.8	1.9	7.4	14.78	nbr. sample
4	1 trench	27	135	104	34.1	8.5	8.0	52.24	Br. sample
5	1 pit	12	55	33	27.4	.3	6.3	51.70	Br. sample
6	1 pit	18	90	84	22.7	.8	5.6	85.45	Visible coarse Au
7	1 trench	20	100	73	31.5	8.0	6.5	5.18	Visible coarse Au
8	1 trench	34	166	78	21.0	3.3	6.6	253.83	High bank cuts
9	1 trench	22	100	83	37.5	1.9	9.1	31.84	nbr. sample
10	1 trench	35)	250	169	39.7	2.9	11.9	3.17	Water on br.
10	1 pit	15)							nbr. sample
11	1 trench	20)	165	127	27.0	6.1	7.0	11.81	Previously placered
12	1 pit	13)							for gold
13*	1 trench	20	100	66	12.6	1.1	2.9	14.27	Overburden note.
14	2 trench	26	140	88	31.9	7.0	6.5	9.58	nbr. sample
15	2 pits	no sample taken							Narrows
21	2 trench	75	400	185	31.9	8.1	8.0	1.49	Coarse Cb-Ta
22	1 trench	35	200	94	23.4	8.0	7.4	.04	Coarse Cb-Ta
23	1 trench	50	240	173	27.3	3.7	7.6	.60	nbr. sample
24	1 trench	39	210	127	25.0	5.2	7.0	2.49	nbr. sample
25	2 trench	80	385	300	19.9	8.7	7.7	9.05	Visible gold
26	2 trench	62	320	200	28.2	7.9	7.0	.43	nbr - water
27	1 trench	53	280	152	24.7	6.7	6.7	.60	nbr - water
28	1 trench	48	245	151	25.1	6.9	6.6	.45	nbr - water

* Overburden begins to exceed 6 inches. Stripping necessary up to area worked by pilot plant 1948-49. (Section 16, map 4)

See map 4 for estimated yardage and recovery values.

SUMMARY

The purpose of this report is to establish, so far as possible, the yardages and values of the Bear and Potato Creek placer gravels. Examination of these gravels show the following:

Bear Creek

Fron Seventy Flats, a total of 855,000 cubic yards of gravel available, including the Sawmill Creek area. If lower Seventy Flats are included, the total will be approximately 1,395,000 cubic yards.

During previous tests, concentrates recovered from test pits, trenches and actual working of gravels showed an average value of 35 cents per cubic yard in gold, 1 pound of metallic tin and high values in scheelite and columbite-tantalite.

During September and October, 1949, 26 sections, each 600 feet in length were surveyed on Bear Creek. Twenty-nine trenches and 21 test holes or pits were dug by caterpillar and dozer, from these excavations 5,015 pounds of gravel was sampled by panning. This panning recovered 3,502 grams or 7 pounds of concentrates, a ratio of 3.2 pounds recoverable per cubic yard of 2,800 pounds. These panned concentrates have an average specific weight of 2.9 as compared with the specific weight of 3.0 calculated for "shipping grade" of 40 percent tin, 10 percent scheelite and 10 percent tantalite, approximated from the specific weight of a control sample of known analysis.

For lower Bear Creek, water is available all year round and sufficient for expanded large scale washing operations. For upper Bear Creek, dams and conservation of water is, in my opinion, essential.

Potato Creek

A total of 399,000 cubic yards available, including terraces and part of Placer Survey 392, from Section 15, map 4, to the junction of Potato and Beaver Creeks.

During September and October, 1949, 24 sections, each 600 feet in length were surveyed on Potato Creek. Thirty-four trenches and 15 test pits were dug and tested. From these excavations 4,301 pounds of gravel was sampled by panning. This panning recovered 2,602 or 5-1/4 pounds of concentrates, a ratio of over 2.5 pounds recoverable per cubic yard of 2,800 pounds. These panned concentrates have an average specific weight of 2.7 as compared with the specific weight of 3.0 for shipping grade concentrates (see Para. 3, Summary, Bear Creek).

Exclusive of recoveries by the Keenan Properties washing plant now in operation, and my previous examination and work on Potato Creek, I estimate the entire Potato Creek to carry values of approximately 1 pound of tin per cubic yard, 60 cents gold per cubic yard in concentrates containing 10 percent in scheelite and columbite-tantalite.

Dams and conservation of spring flood water will be essential for any washing plant operation in the Potato Creek Placers.

GENERAL

The present machinery being operated by Keenan Properties is capable of a small and limited daily production with inevitable high costs. The same crew at approximately the same or lower cost can and should operate a larger washing plant capable of handling at least 850 cubic yards per 8-hour shift.

While both Bear Creek and Potato Creek carry well-proven values in the present channels, it is the opinion of the writer that more attention should be paid to the high bars and old river channels, with their greater yardages and probable high values. It is also the opinion of the writer that both Bear and Potato creeks can be placered at a profit. Costs on lower Bear and lower Potato creeks will be much less than on the upper levels, due to such factors as shallower gravels, higher pumping heads, narrower channels and steeper grades.

W. C. Driskill
October 27, 1949

Testwork reported by Oscar N. Bribach, in addition to the Assays heretofore submitted with the Driskill Report.

Jan. 1950 - My experience leads me to the conclusion that although we learn much from the activities of others with similar problems, the knowledge gained by working with ore is the knowledge which prevents losses. I would like to make a business arrangement with you, whereby I could work on your problems and receive a $400 per month salary.

April 7 - I did not separate the Columbium oxide from the Tantalum oxide. Enclosed please find samples A and B. I suggest that you submit these samples in lieu of an assay certification to the Munitions Board for their examination, and use the information as to price to be paid by the Military Establishment.

April 10 - My work to date was to make a 70% tin product. The crude earth acid product is a product of this separation and is represented by samples A and B. A spectrographis examination indicates the ratio of Cb205 to Ta205 is approximately 1:1 - the combined earth acids approximately 50% and the Ti02 approximately 20%.

April 22 - I have been working on the 2 to 1 ratio problem since receiving your letter. This work which requires the analysis of the products for Cb205 and Ta205 slows down the work.

I am pleased to learn of your plans to engage my services as Chief Consultant of Chemical assays and Separation. In another week I may have enough laboratory dat to justify the feasibility o of processing the earth acids into any desired ratio.

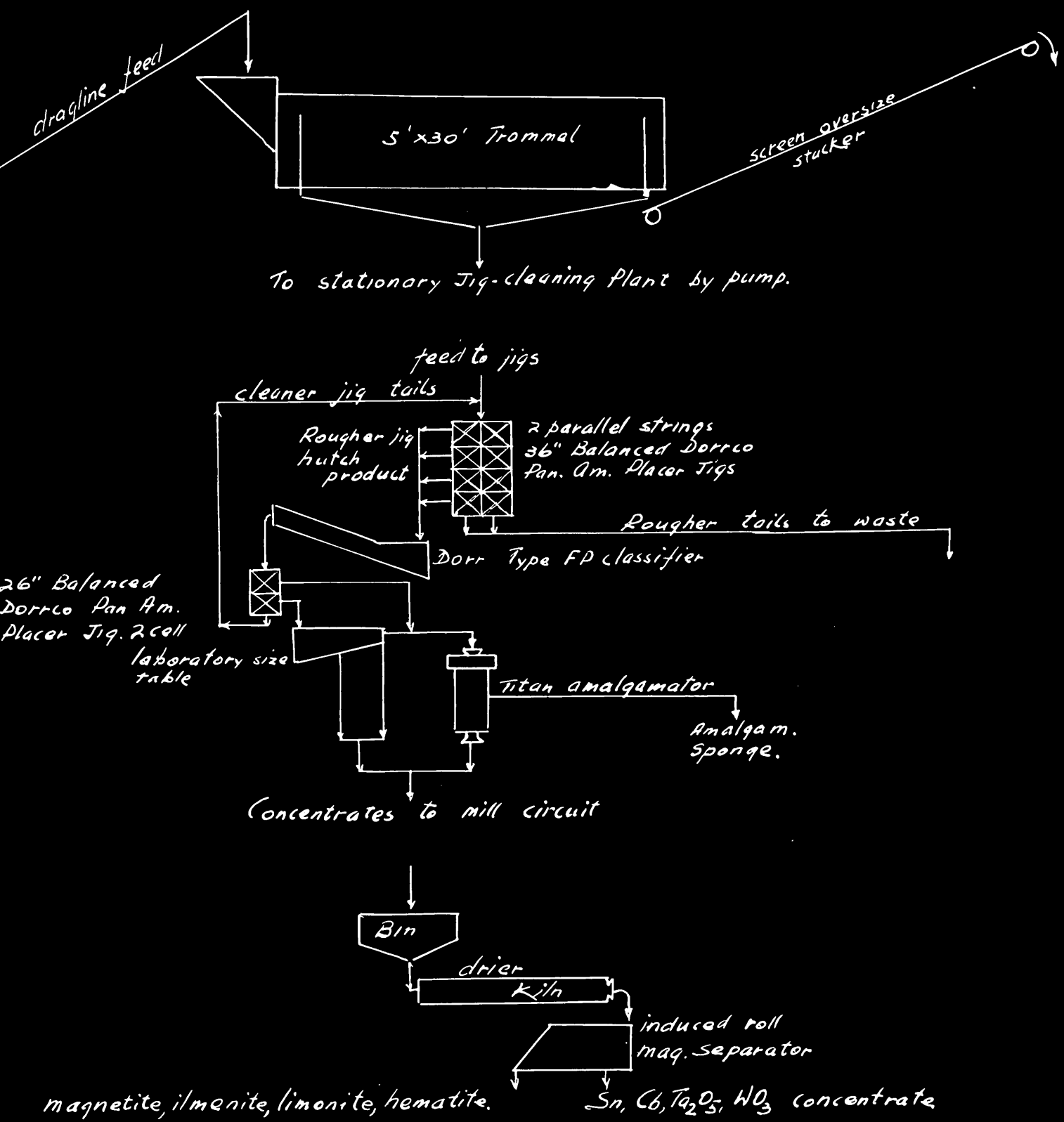
June 30 - During our recent telephone conversation you informed me that your plans included me as Consultant on a contract basis. I am now submitting a general statement of my idea to separate the gravity product concentrate of the placer operation.

The idea is to remove the magnetic minerals and decompose the non-magnetic product by a pyrosulphate fusion. Remove iron - titanium etc by treating the melt withnacidulated water. The tin mineral is separated from this earth, tungstic acid silicate residue by gravity concentration. The gold is recovered from the tin concentrate by amalgamation. The tungstic acid is separated from the earth acids chemically, (a potassium carbonate fusion followed by precipitating the tungstic acid with a sodium salt.) The earth acid residue from this separation is converted to oxides and the Ta205 is separated from the Cb205 by the hydrofluoric acid method.

I have studied the scheme in a qualitative manner and have succeeded in making satisfactory end products.

The used chemicals in making the pyrosulphate melt may be valuable as plant food, the sale of which would help to defray the costs of the reagents.

Placer Operation Flowsheet
Capacity 3,000 cu. yds per 24 hours.



Note: Coarse Au recovered from #1. hutch basket, cleaner-jig. Iron biproduct shipped direct to Rapid City Cement Co. Sn, Cb-Ta, WO_3 to Texas City, and G.S.A. as per contracts 1950.

KEENAN PROPERTIES
Deadwood, South Dakota

Breakdown of Equipment, Machinery and Capital Requirements for Placer Program 1951.

Contents

"A" List of Equipment and Machinery available through government warehouses.

"B" List of Equipment and Machinery to be purchased for Placer washing and cleaning plants.

"C" Construction and Assembly Fund Expenditures.

"D" Requirements for Dams, Transportation, Bldgs. Office.

"E" Specialized Services, Equipment, Consultants' fees, Separation Equipment. Legal.

"F" Miscellaneous Expenditures.

"G" Recapitulation, total requirements.

A.

Equipment and Machinery available through government warehouses and requested as part of funds guaranteed.

1 - 2 cu.yd. type 802 Lima Dragline, 50' boom with 15' section Page 2 yd. bucket 36" tracks, incl. freight	51,090.00
1 - 1500 Watt Kohler light plant for Dragline	750.00
1 - D-8 Caterpillar, Cab, lights, idler and gearguards, cable control with #80 scraper, straight dozer	31,586.00
1 - D-8 Caterpillar, lights, idler & Gear guards angle dozer, cable control front	17,824.00
1 - 300 KW diesel generator,portable	15,000.00
2 - 10 KW Kohler light plants, portable, gasoline	3,430.00
1 - 300 watt arc welder, gasoline, portable	1,750.00
1 - Athey wagon	3,500.00
2 - Fuel tanks, 500 gal. capacity, portable	800.00
1 - Semi-portable stacker conveyor, 100' centers, 36" belt, with motor	2,800.00
1 - Dump Truck, 5 ton (diesel) end dump	5,000.00
1 - 5" Portable slime pump, gasoline (Pecault)	1,000.00
1 - 3" Portable clear water pump, gasoline motor	510.00
1500'-3" Flexible hose for 3" pump	400.00
2 - 1" Sand Pumps, electric motors, intake hose, ft. valve	700.00
2 - 1" deep well, electric pumps, with pressure tanks	260.00
550'-1" Rubber hose	75.00
3 - Sets spare cable for dragline 802	300.00
Estimated totals	$136,775.00

(Dragline, D-8 Cats, with accessories, are priced as of 1 Jan. 1951

B.

List of Equipment & Machinery to be purchased for Washing and Cleaning Plants.

1 - 8" Sand Pump, diesel powered, hydroseal type with 25' intake hose and foot valve	5,000.00
2000'- 8" Lockstream, Spiral Weld, Naylor Pipe	3,000.00
1 - Trommel screen, 72" diameter, 5' scrubber 16' at ½" perforations 9' at 3/4", 4' discharge (S-A-10)	6,000.00
2 Sets Athey tracks, 15 ton wheels, 10' 7" base width	7,500.00
1 - Titan Amalgamator, continuous flow & motor	1,800.00
1 - Dodge Power wagon, front winch, rear p.t.-off	2,780.00
1500'- 5" Lockstream, Spiral weld, Naylor pipe	1,800.00
1 - 15 h.p. d.c. motor for 4" sand pump	325.00
Misc. Elec. Motors 220/440 v. 2 ph. S. cycle	3,00.00
1 - Spiral Screw dehydrator, dewatering	2,700.00
1 - Trommel hopper w/grizzly	2,000.00
1 - Trommel distributor	750.00
1 - Wilfley, concentrating table, Lab. size (7')	725.00
500'- Black Iron pipe 2" dia. sleeves, elbows, T's.	145.00
1000'- Black iron pipe 3/4"-1½" dia. elbows, T's	252.00
1 - Cement Mixer, 1 cu.yd. capacity, gasoline drive	225.00
150 - Sacks Cement	165.00
Misc. Lumber, tar paper, putty, glass, nails	1,000.00
1 - Flask mercury	96.00
3 - Ore feeders with electric AC motors	1,000.00
Misc. Testing equipment, mill and laboratory	1,387.00
1 - Rotary Kiln Drier (Custer)	350.00
1 - Dings Magnetic Separator	1,000.00
	$43,000.00

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C.

Construction and Assembly Fund. Labor, Parts, Washing and Cleaning Plant erection and installation.

Misc. Administration, Executive expenses	$ 11,200.00
Engineer Superintendant	2,500.00
Carpenters	3,136.00
Welder mechanics	2,352.00
Machinists	2,352.00
Helpers	4,032.00
Bookkeeper, stenographer	1,120.00
Advance Compensation Insurance	1,500.00
Overtime and Contingency labor	3,000.00
Insurance on Mill and Placer Equipment	500.00
Royalties, monthly advance	1,000.00
Parts and Materials	5,500.00
Contingency materials, parts, dams.	5,182.00
Travel expenses	3,800.00
Fuel, diesel and gasoline	1,200.00
	$ 48,374.00

D.

Dams, Transportation, Buildings, Office

1 - dam Potato Creek	2,500.00
2 - dams Bear Creek	6,000.00
1 - Automobile executive	2,200.00
2 - Chemical toilets, septic tanks	400.00
Misc. Repair Blacksmith Shop	500.00
" Sewage disposal Mill Camp	50.00
" Repair 2nd Floor Commissary bldg.	150.00
" Wiring & lighting fixtures, mill	1,000.00
" Fire extinguishers, quarters	450.00
" Reconditioning personnel quarters	600.00
1 - Typewriter	175.00
Misc. Stationery & Supplies	75.00
" File cabinets	100.00
" Office, commissary equipment	800.00
	$ 15,250.00

E.

Specialized Services, Equipment, etc.

The Dorr Company, Stamford, Connecticut. Pan American, Placer Jigs, roughers and cleaners, Type FP Classifier, Installation and initial operation, Engineering fees as outlined in contract proposal	16,100.00
Mr. Oscar N. Bribach, Chemist, Aurora, Colorado, Separation equipment, Machinery and Supplies.	20,000.00
Services, 1 month	1,600.00
Mr. Walter Johnson, Consultant	2,500.00
Legal fees, contracts, etc.	2,500.00
	$42,700.00

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F.

Miscellaneous

Black Hills Power & Light Co. Highline	3,250.00
Accounts, Notes payable	36,500.00
Freight	10,000.00
Operating Fund, 60 days	42,505.00
	$92,255.00

G.

Recapitulation.

Sheet A.	Government supplied equipment.	$136,775.00
B.	Washing and Cleaning Plants.	43,000.00
C.	Construction & Assembly Fund.	48,374.00
D.	Dams, Transportation, Buildings.	15,250.00
E.	Specialized Services, Separation Equipment.	42,700.00
F.	Power & Light, Accounts, Operating Fund,	92,255.00
	Contingency Fund at 10%	37,835.00
	Total	$416,189.00